

WHAT IS CLAIMED IS:

1. A method for operating the spacecraft-related portion of an arrangement for transmitting Available Bit Rate service Asynchronous Transfer Mode (ATM) data over a transmission path including a spacecraft, where the spacecraft includes transmission path ATM data routing switches which lack capability for marking Resource Management cells with congestion information, said transmission being in an Available-Bit-Rate operating mode in which data is transmitted over the transmission path in bandwidth which is otherwise unused by services other than Available Bit Rate service Asynchronous Transfer Mode data, said method comprising the steps of:
 - at a source terminal which transmits said Available Bit Rate service Asynchronous Transfer Mode data to said spacecraft, receiving from a source node Available Bit Rate service Asynchronous Transfer Mode data including Resource Management cells, and deleting the Resource Management cells from the stream of Available Bit Rate Asynchronous Transfer Mode data flowing to the spacecraft, so as to reduce the amount of superfluous data flowing in an ABR bandwidth portion of the spacecraft resources;
 - determining at least the presence of absence of congestion in the spacecraft payload in paths associated with said Available Bit Rate service Asynchronous Transfer Mode data by means other than by use of said routing

switches, to thereby produce spacecraft-congestion-related signals;

35 coupling said spacecraft-congestion-related signals by way of at least a downlink to said source terminal; and

40 at said source terminal, using information derived from said spacecraft-congestion-related signals to mark back Resource Management cells for return to said source.

2. An arrangement for transmitting Available Bit Rate service Asynchronous Transfer Mode (ATM) data over a transmission path including a spacecraft, said Available-5 Bit-Rate operating mode being one in which data is transmitted over the transmission path in bandwidth otherwise unused by services other than said Available Bit Rate service Asynchronous Transfer Mode data, said arrangement comprising:

10 a source of Available Bit Rate service Asynchronous Transfer Mode data which generates Resource Management cells and combines said Resource Management cells with information data to form said Available Bit Rate service Asynchronous Transfer Mode data to be transmitted, and which is responsive to 15 congestion-indicative information contained within returned Resource Management cells for adjusting the transmission rate of at least said Asynchronous Transfer Mode data portion of 20 said Available Bit Rate service Asynchronous

Transfer Mode data to tend to maintain in use,
for said Asynchronous Transfer Mode data, said
25 bandwidth otherwise unused, while tending to
avoid congestion which might otherwise result
in loss of Asynchronous Transfer Mode data
cells;

30 a spacecraft including transmission
data path switches which do not mark Resource
Management cells with congestion information,
and a terrestrial Network Control Center
communicating with said spacecraft, said
Network Control Center co-acting with said
35 spacecraft to determine the level of congestion
in at least one service other than said
Available-Bit-Rate service Asynchronous
Transfer Mode data, and to tend to control said
congestion in said at least one service other
40 than said Available Bit Rate service
Asynchronous Transfer Mode data by means of
payload congestion control signals transmitted
between said spacecraft and said Network
Control Center over a signal path including an
45 uplink and a downlink;

50 a terrestrial spacecraft source
terminal coupled to receive Available Bit Rate
service Asynchronous Transfer Mode data from
said source of Available Bit Rate service
Asynchronous Transfer Mode data, and
communicating, by means of uplinks and
downlinks, with said spacecraft, said
spacecraft source terminal being arranged for
receiving Resource Management cells associated
55 with said Available Bit Rate service

Asynchronous Transfer Mode data, and for
marking said Resource Management cells in
locations indicative of at least the presence
or absence of congestion, and of returning said
60 Resource Management cells, so marked, toward
said source of Available Bit Rate service
Asynchronous Transfer Mode data, in the form of
back Resource Management cells, and also being
arranged for transmitting at least said
65 Asynchronous Transfer Mode data portion of said
Available Bit Rate service Asynchronous
Transfer Mode data to said spacecraft over an
uplink;

means located at said terrestrial
70 spacecraft source terminal for receiving said
payload congestion control signals, and for
marking said Resource Management cells with
payload congestion information derived from
said payload congestion control signals
75 originating from said Network Control Center,
thereby closing a control loop including said
source of Available Bit Rate service
Asynchronous Transfer Mode data, said
terrestrial spacecraft source terminal, and
80 said spacecraft, whereby congestion of said
Available Bit Rate service Asynchronous
Transfer Mode data tends to be controlled in
that portion of said transmission path
including said source of Available Bit Rate
85 service Asynchronous Transfer Mode data, said
terrestrial spacecraft source terminal, and
said spacecraft.

3. An arrangement according to
claim 2, further comprising:

means at said terrestrial spacecraft
source terminal for deleting at least some of
5 said Resource Management cells from said
Asynchronous Transfer Mode data which is
transmitted over said uplink to said
spacecraft; and

10 a terrestrial destination terminal
coupled to said spacecraft by uplinks and
downlinks, said terrestrial destination
terminal including means for adding forward
Resource Management cells to said Asynchronous
Transfer Mode data cells, and for receiving
15 returned resource management cells from
downstream locations, for thereby spoofing
downstream locations which expect to receive
Resource Management cells during Asynchronous
Transfer Mode data operation.

4. An arrangement according to
claim 2, wherein said coaction of said
spacecraft and terrestrial Network Control
Center to determine the level of congestion in
5 said at least one service other than said
Asynchronous Transfer Mode data Available Bit
Rate service produces a signal explicitly
representative of payload congestion.

5. An arrangement according to
claim 2, wherein said Resource Management cells
of said Available Bit Rate service Asynchronous
Transfer Mode data are transmitted from said

5 source terminal to a destination terminal by
way of said spacecraft, and said destination
terminal transmits said Available Bit Rate
service Asynchronous Transfer Mode data which
are received from said spacecraft to locations
10 downstream of said destination terminal, and
wherein back Resource Management cells arriving
at said destination terminal are transmitted to
said source terminal by way of said spacecraft,
said arrangement further comprising;

15 congestion information marking means
located at said source terminal, for receiving
said back Resource Management cells, and for
controllably marking said back Resource
Management cells with information derived from
20 said payload congestion information, so that
Resource Management cells returning toward said
source of Available Bit Rate service
Asynchronous Transfer Mode data include
congestion data for controlling the cell rate
25 of said Available Bit Rate service Asynchronous
Transfer Mode data generated by said source of
Available Bit Rate service Asynchronous
Transfer Mode data for tending to control at
least one of congestion at said spacecraft and
30 at other locations of said transmission path.

6. A method for operating at least
the spacecraft-related portion of a spacecraft
data network for Available Bit Rate service
Asynchronous Transfer Mode data, where routing
5 switches of said spacecraft are not used for
marking the data stream with congestion

information, said method comprising the steps of:

at a source terminal, receiving said
10 Available Bit Rate service Asynchronous Transfer Mode data, and transmitting said Available Bit Rate service Asynchronous Transfer Mode data, together with its Resource Management cells, to a destination terminal by
15 way of said spacecraft, whereby said Resource Management cells of said Available Bit Rate service Asynchronous Transfer Mode data arriving at said destination terminal do not carry spacecraft congestion information
20 relating specifically to said Available Bit Rate service Asynchronous Transfer Mode data;
determining spacecraft payload congestion attributable to a plurality of services, including services other than said
25 Available Bit Rate service Asynchronous Transfer Mode data, to thereby generate payload congestion signals;
transmitting said payload congestion signals to said source terminal; and
30 at said source terminal, controllably marking said Resource Management cells of said Available Bit Rate service Asynchronous Transfer Mode data with information derived from said payload congestion signals.